UNITED NATIONS

ECONOMIC AND SOCIAL COUNCIL

Distr.
LIMITED

E/ECA/CMU/27
4 November 1988

Original: ENGLISH

UNITED NATIONS
ECONOMIC COMMISSION FOR AFRICA

Regional Seminar on Satellite
Communications Technology

Moscow, USSR, 11 to 26 July 1988

LC/NAIROBI

REPORT

REGIONAL SEMINAR ON SATELLITE COMMUNICATIONS TECHNOLOGY

1. INTRODUCTION

1. Within the framework of the ECA/USSR Co-operation and as a contribution to the World Communications Year (WCY) 1983, ECA and ITU jointly organized the first Regional seminar on the Principles of Development of Satellite Communication systems and the Efficient Use of the Geostationery Orbit. The seminar was held in the USSR from 26 July to 4 August 1983. It was financed under the USSR/UNDP Trust Fund with the co-opeation of the Ministry of Posts and Telecommunication of the USSR.

2. The seminar aimed at upgrading the knowledge of senior African professionals with communications/electronic engineering background.

2. ORGANIZATION AND FUNDING

3. This seminar was the second in a series of Regional Seminars on Satellite Communications Technology, jointly organized by the United Nations Economic Commission for Africa (ECA) and the USSR Government within the framework of ECA/USSR co-operation programme. It was financed under the UNDP/USSR Trust fund with the co-operation of the Ministry of Posts and Telecommunications of the USSR. The seminar was held in the USSR, Moscow, Dubna and Sochi from 11 to 26 July 1988.

4. The seminar was announced by ECA to all fifty member States of the United Nations Economic Commission for Africa on 11 March 1988, requesting nominations from each country of which only one candidate would be selected and sponsored by the project.

5. The Ministry of Posts and Telecommunications of the USSR hosted the seminar and provided the protocol and transportation.

6. The ECA prepared and co-ordinated the project, undertook the administrative arrangements for organizing the seminar provided a bilingual secretary and administrative support for the duration of the seminar as well as serviced and co-presided over all sessions of the seminar.

7. The International Telecommunications Union (ITU) and the Pan-African Telecommunications Union (PATU) gave support by providing two and one lectures respectively at their own expense.

3. OBJECTIVE

8. The primary objective of the seminar was to provide a forum where senior African professionals concerned with communication policy and planning in telecommunications and broadcasting (radio and television) in their respective countries, lecturers and other experts could share, over the two weeks duration,

their experiences on specific issues related to the development of satellite communications technology and its applications, particularly in the African environment.

9. The seminar was also designed to offier opportunity to participants to acquire detailed knowledge of operational satellite communications systems and technology and future trends. As a result, the knowledge gained would be applied to their daily works including the on-going feasibility study on the Regional African Satellite Communications System (RASCOM).

4. ATTENDANCE AND PARTICIPATION

10. Representatives of the following thirty member States of the Economic Commission for Africa participated in the seminar: Algeria, Angola, Benin, Burkina Faso, Burundi, Congo, Cote d'Ivoire, Djibouti, Egypt, Ethiopia, Equatorial Guinea, Guinee, Guinee Bissau, Kenya, Libya, Madagascar, Mali, Mozambique, Niger, Rwanda, Sao Tome and Principe, Senegal, Sierra Leone, Sudan, Swaziland, Tanzania, Tchad, Togo, Uganda and Zambia. The seminar was also attended by representatives of ECA, PATU, ITU and the Ministry of Posts and Telecommunications of the USSR as well as invited guests from Glavkosmos, USSR, Institutue of Space Research of the USSR Academy of Science, State Committee for People's Education, India and TELSA - CZECHOSLOVAKIA.

5. OPENING CEREMONY

11. The opening ceremony of the seminar was conducted by Mr. Zubarev Y. B., the USSR Deputy Minister for Telecommunications, who in his statement welcomed participants and said among other things, that it was his hope and that of his Government that the seminar would be a success. Statements were also delivered by Mr. Rajabu M. Yusuf, Secretary General of PATU, Mr. Thomas J. Baxter, Acting Chief Communiations Unit, Transport Communications and Tourism Division, on behalf of the Executive Secretary of the ECA and a representative of the USSR, MVES. They all in the main expressed their appreciation to the host government and hoped for maximum benefits of the seminar to the participants.

12. In particular, the statement of ECA traced the Commission's activities related to the planning and development of telecommunications in Africa during the United Nations Transport and Communications Decade and its future actions. The speaker emphasized the need to extend basic telecommunication services to the rural areas, which provide the opportunity of economic growth at both national and regional levels.

13. As regard the future development of telecommunications in Africa, he referred to the PANAFTEL Network and the on-going feasibility study for the proposed RASCOM projects, which if successfully implemented as planned would provide the African countries with integrated telecommunications system, satisfying the telecommunications requirements of the various national networks be it urban, rural, subregional or regional or international. The end result would be the encouragement of rapid development in all other sectors of the economy.

6. WORK PROGRAMME

14. The seminar was organized for 16 days excluding travel time. It began on schedule as programmed, 11 July 1988 with the opening ceremony.

15. The seminar programme consisted of lectures, study tours to Dubna and Sochi and discussions on various aspects of communications technology, operations and applications by experts from the Ministry of Posts and Telecommunications of the USSR, the Economic Commission for Africa (ECA), the Organization of African Unity (OAU), the International Telecommunications Union (ITU) and the PAN-African Telecommunications Union (PATU) as well as other invited guests from GLAVKOSMOS, USSR, Institute of Space Research of the USSR Academy of Science, State Committee for People's Education, India and TESLA -Czechoslovakia.

7. SUMMARY OF LECTURES

16. The programmes of the seminar and the list of participants and lectureres appear as annexes I and II to this report.

17. The following are summaries of the twenty-nine lectures in their order of presentation.

1. Current Satellite Telecommunications Techniques and Services (Mr. B. Humm, ITU).

18. The recent shift in emphasis from sophisticated earth segments to the need to increase reception sensitivity and power emitted by the satellites has resulted into simpler earth stations and smaller antennae. This has consequently reduced the cost of the ground segment and increased the attractiveness of satellite communications for a large number of locations requiring low levels of traffic, that is, for the development of telecommunications in rural areas.

2. Prospects of Space Technology and Applications in Africa (A.S. Koram, OAU).

19. The paper examines the development of space technology and its possible application towards the attainment of the development objectives of Africa, namely, the promotion of an African economic community. Satellite communications technology can be used for both broadcasting and common carrier communications.

20. The paper also emphasized the importance to Africa of the upcoming WARC-ORB 88 meeting on allocation of services. It is hoped that the African countries, with the assistance of PATU, will be able to present a co-ordinated position at the meeting.

3. Co-operation Between the Member Countries under the INTERCOSMOS Programme on Satellite Communications (Kantor L. Ya, Borovkov V.A.; USSR Ministry of Posts and Telecommunications)

21. The main purpose of the INTERCOSMOS programme is to conduct joint research and develop new and advanced satellite communications technology. The most

important results which have been obtained since the start of the programme in 1967 include the establishment of the INTERSPUTNIK system and associated equipment, most notably the FDDM-adaptive PCM equipment designated MdVR-40 designed for digital information transmission at 40 Mbit/s. Another equipment is the INTERCHAT FDMA system which employs SCPC digital technique.

22. To improve the efficiency of research, an International Experimental Centre of Satellite Communications called DUBNA - INTERCOSMOS was established at Dubna under this programme. A number of other important projects have also been undertaken under this programme including the MOSKVA satellite television broadcasting system.

4. Current Regulatory Procedures for the Use of the Geostationary Satellite Orbit and Possible Approaches to their Improvement at the Second Session of the WARC - ORB 88 (Timofeev V.V.; USSR Ministry of Posts and Telecommunications).

23. The paper addressed mainly the regulatory procedures on the use of geostationary satellite orbit and made proposals for simplifying some of these procedures. In particular, it proposed that the coordination procedures of Article 11 be combined with the procedure of multilateral meetings, provided it is applied to all services which are not planned.

5. Co-operation Between the CMEA Member Countries Under the Comprehensive Programme for Scientific and Technological Development in the Field of Satellite Communications (M. Rober; USSR Ministry of Posts and Telecommunications).

24. One of the priority areas of the co-operation programme concerns the improvement of earth station facilities, development of a new generation of high capacity TV broadcasting and communications satellite systems. The programme has two basic objectives: to develop 12 GHz satellite sound and TV broadcasting systems; and to improve the equipment of earth stations in satellite communciation systems. As part of the later, the USSR is developing advanced time-division multiple access equipment (MDVR-60) for ESS and digital circuit multiplication equipment with digital speech interpolation, which will treble the capacity of satellite communication links.

6. The Soviet Space Technology: Trends of Development and Opportunities of Using it on a Commercial Basis (A.P. Bachurin; GLAVKOSMOS, USSR)

25. The paper reviews the major developments in Soviet Space programme and their possible applications. It summarizes the developments in earth observation and environment monitoring technology, space communications and information systems, space navigation satellite and technology for the production of materials and manufacturing of products in space. The paper also summarized the role of Glavcosmos, the USSR Space Agency.

7. Main Results of CCIR Studies on the Satellite Television Broadcasting (M.I. Krivosheev and V.A. Borovkov; USSR Ministry of Posts and Telecommunications).

26. The paper summarizes the main recent international advances in satellite television broadcasting. These include the following: Recommendation 650 on TV standards for satellite broadcasting, the channels defined by WARC BS-77 and RARC SAT-83; Report 215-6 "Systems for the Broadcasting Satellite Service; Report 632-3, "Broadcasting Satellite Service· Technically suitable methods of modulation"; adoption of a number of texts on the studies on a definition of preferred characteristics, design principles and practical implementation of earth and space segments of the TV broadcasting satellite service; and the studies carried out by CCIR on the matters relating to planning of TV broadcasting satellite service in the 12 GHz band.

8. Planning of the Use of the Geostationary-Satellite Orbit by Satellite of the fixed Satellite Service (Mr. L. Ya Kantor; Ministry of Posts and Telecommunications of the USSR)

27. The paper pointed out that the geostationary orbit is most actively used by fixed satellite services (FSS) as compared to other space services. The FSS Satellite systems differ considerably by their technical parameters, by way of operations and by functions they perform. They are commonly used for the transmission of telephony, television and data.

28. With this background, the paper considered the methods of planning the efficient geostationary orbit utilization and the means for determining factors for such efficiency. Furthermore, the paper identified the two existing fundamental approaches to the use of the GSO and frequency band namely: the international co-ordination of the notified new systems with the existing systems and their subsequent registration with the IFRB and the international plans adopted for the utilization of separate frequency bands.

9. RASCOM in the Context of WARC-ORB (2) (B. Humm; ITU)

29. The feasibility study of the Regional African Satellite Communication System for the development of Africa (RASCOM) is a total telecommunications network study for Africa with a view to ascertaining the long-term telecommunications requirements and providing efficient and well-managed communication infrastructure facilities for the development of the continent as a whole. The paper stressed the importance of the upcoming WARC-ORB to RASCOM since the Allotment Plan for RASCOM will be considered, and urged the African countries to carefully articulate their positions at the conference.

10. The Challenges of Communications Development in Rural Africa (R.M. Okello; Economic Commission for Africa).

30. The paper summarizes the state of telecommunications development in Africa, highlighting in particular the results attained during the programme of the United

Nations Transport and Communications Decade in Africa (1978-1988). The major challenges to the development of communications services in the rural areas of Africa, namely, financial, technological, geographic and demographic problems, are discussed and possible solutions are proposed. These include the possible applications of satellite communications technology.

11. Satellite Television Broadcasting System EKRAN-M (D.L. Zajtsev; USSR Ministry of Posts and Telecommunications)

31. The paper presents recent developments in satellite TV broadcasting in the Soviet Union. The EKRAN Satellite TV broadcasting system operates in the UHF band so that a wide network of low-cost receiving earth stations may be used. During the decade since the EKRAN system was introduced, the demand for TV has significantly increased.

32. In order to provide service to the many time zones in the USSR, the EKRAN system has been modified to EKRAN-M satellite with a special two-channel transponder operating at two frequencies, thus doubling the number of television programmes transmitted. Earth stations capable of receiving programmes in both channels have also been developed.

12. Earth Stations in the USSR Satellite Communications System (G.A. Korolev; Ministry of Posts and Telecommunications, USSR).

33. This paper presents general design concepts for earth stations used in the national satellite communications network. There are seven main categories of earth stations in use in the USSR. These are: central, multi-purpose transmit-receive earth stations; central earth stations for broadcasting service; satellite transmit-receive stations of the first class; transmit-receive stations of the second class; TV receiving stations of second class; and transportable stations.

13. Container-Type Earth Stations Designed in the USSR (Y.M. Payansky, K.G. Trakhtenberg; USSR Ministry of Posts and Telecommunications).

34. Over the last decade, the Soviet specialists developed containerized earth stations for satellite communications. These stations can be adapted to the equipment used, climatic conditions and customer requirements, and are designed for reception and transmission of different types of communications including TV, low capacity multiplex telephony, broadcasting programmes and data. These stations have many advantages compared to the conventional fixed types.

14. Development of Satellite Communications in Africa (M. Boye; Pan-African Telecommunications Union)

35. The paper presents the development of satellite communications in Africa in historical perspective of its world-wide development. Satellite communications was introduced into Africa soon after the technology became operational and international organizations (INTELSAT) for its use created in 1964/65. The installations in Africa were mostly established in the 1970's. Today 48 of the 50 member countries of the OAU operate satellite communications systems. Now the

African countries are carrying out a feasibility study for establishing their own regional satellite communication system called RASCOM.

36. Other related issues discussed by the paper are operation, maintenance and training as important elements of telecommunications development in Africa.

15. Satellite Business Communications (K.G. Matapurki; India)

37. The paper considered the phenomenal growth in computer technology and its applications on one hand and the rapid developments in digital satellite communication on the other which have led to the evolution of efficient and cost effective satellite based business communications.

38. Furthermore, the paper pointed out that several industrial, commercial and financial organizations and corporations, both government and private, are increasingly using their own satellite telecommunication links between their widely dispersed locations for providing telematics services. Very small aperture earth terminals (VSATs) are used in customer premises to provide links with high reliability, and flexibility at low costs. Some of these services are now operational and/or planned in India under INSAT system.

16. Operation and Maintenance of Space Telecommunications in India (R.D. Arya; Department of Telecommunication, India)

39. India first established domestic satellite communication system in mid 79's using leased transponders from different satellites. With the launching of its own satellite, the multipurpose INSAT-1, India expanded the ground segment of more than 28 earth stations between 1978-1981. This allowed the expansion of long distance communication to many remote locations. Besides telephony, the INSAT satellite is used for broadcasting as well as meteorological services.

40. The paper also discussed the maintenance procedures for the earth station.

17. MARSAT (V/O Morsvjazsputnik)

41. MARSAT is an organ of the USSR Ministry of Merchant Marine and is involved in the field of electronic- radio navigation and satellite communications. it ensures utilization of space satellite systems for maritime communications. It is the USSR agency for co-operation with the relevant international organisations namely, IMO, INMARSAT, ITU, INSA, ESA INTERSPUTNIK, INTERCOSMOS, COSPAS-SARSAT and the Commission du Danube.

SECOND SEMINAR'S SESSION AT THE INTERNATIONAL SATELLITE COMMUNICATION CENTRE AT DUBNA

18. Overview Excursion around the International Satellite Communications Centre "Dubna" (S.N. Dobromyslov, Ministry of Posts and Telecommunications of the USSR)

42. The lecture described the Dubna Communications Centre and its activities. The Dubna Centre uses two types of systems for International Telecommunications Services namely: The intersputnik 12-meter antenna and the INTELSAT Standard A Earth Station. The Intersputnik system provides all telecommunication services in the USSR and to all Intersputnik members. It is also used for Moskova and EKRAN direct television broadcasting system within the USSR. The lecture was followed by a tour of the Dubna Communications Centre where details of the various equipments and operations were explained.

43. The International experimental center, which is part of the Dubna communication centre, was also visited where a demonstration of the 12/24 mbit/sec digital television equipment was performed.

19. International Experimental Segment Dubna - Intercosmos (V.L. Bykov; Ministry of Posts and Telecommunications of the USSR)

44. The paper outlined the scientific and experimental investigations of the development of new frequency bands for satellite communications between participating partners. The frequency bands currently under investigations at the centre for satellite communications are those bands above the 10 GHZ and primarily the 14/11 GHZ and 30/20 GHZ bands.

45. The lecturer observed that the current satellite networks developed for the 6/4 GHZ band is presently fully occupied and the development of these new frequency bands would not only expand the capabilities of the existing radio systems quantitavely but owing to their specific features, open up new posibilities which would enable the establishment of new and advanced systems.

20. Measuring Basic Technical Characteristics of the Satellite Transponder (S.N. Dobromyslov; Ministry of Posts and Telecommunications, USSR).

46. The paper describes the measuring set that has been developed and is used at the INTERSPUTNIK monitoring station in Dubna. Operational experience shows that measurements can be made once in three months in order to maintain an optimal operation of the satellite communication system.

47. To carry out the measurements the transponder operating point is determined. For this point, the operational transponder gain and the earth station EIRP are to be chosen so as to keep the difference in thermal noise between the up-link and down-link in the 7-10 dB range. This involves accurate measurement of the EIRP in the saturation mode, the power flux density produced at the onboard receiving antenna input, the figure-of-merit, the transponder gain with low signals, etc.

21. New Techniques for Transmission of Enhanced Quality and High-Definition Television by Satellite (V.S. Rabynorich; D.A. Feodorov, V.A Bykhovsky; Ministry of Posts and Telecommunications, USSR)

48. An enhanced quality television system (ETV) is a 525/60 or 625/50 t.v. system which can provide an aspect ratio of 4.3. High definition television system (HDTV) features spatial resolution of about twice that in the existing systems, improved colour rendition, separate luminance and colour difference signals, as well as wider aspect ratios.

49. The paper reports on the development of these systems in the USSR. At present a 1375/50 digital standard is under development. Its advantage is that it is compatible with the 625/50 tv standard which allows continued use of available for sets. Further studies are being carried out to design equipment of HDTV transmission over communication links.

22. Efficient Methods of Digital Conversion of TV Signals in Satellite Systems (N.G. Kharatishvili, State Committee for People's Education, USSR

50. The paper introduced the use of digital transmission methods in TV Satellite Communication Systems and the problem of compressed conversion of original analog TV signals to a digital form. The problem is due to the existing limitations on satellite channels capacity. However, the paper noted that there are a number of methods in use to solve this problem. These methods are arbitrarily subdivided into two groups: the element and block coding.

51. In conclusion the paper observed that despite a variety of methods of efficient digital coding of TV signals, the prediction methods from experience gained in the USSR and abroad, are widely used at present owing to a simple implementation and a relatively high efficiency.

23. Efficient Coding Techniques for Satellite Links (Victor L. Banket; Ministry of Posts and Telecommunications of the USSR)

52. The lecture was a follow-up to the previous one where the methods of digital conversion of TV signals in Satellite system were presented. The lecturer analyzed mathematically the various modulation and error correction techniques which would provide the most efficient use of a satellite link.

53. In conclusion, the lecturer observed that the choice of a modulation method with different sets of signals permits a flexible tradeoff between the power efficiency and the normalized rate to increase the overall capacity of FDMA digital Satellite Communication Systems.

THIRD SEMINAR'S SESSION AT THE
INTERNATIONAL SATELLITE COMMUNICATIONS CENTRE - DUBNA
INTERCOSMOS SITE NUMBER 4
AT SOCHI

24. Statistical Power Budget Calculation for Satellite Links above 10 GHz (V.L. Bykov, Ministry of Posts and Telecommunications, USSR)

54. The paper proposes a new method of calculating some of the parameters in the general communication equation defining the impact of such factors as atmospheric attenuation, antenna pointing and antenna noise on the signal-to-noise ratio. The statistical power budget calculation takes into account the statistical independence of these factors and thus produces a lower value of the signal-to-noise ratio than that obtained using the conventional method.

25. Attention on Space and Terrestial Communication Links at 10 GHz and above (V.N. Pozhidaev; Institute of Space Research, USSR Academy of Science).

55. The paper summarizes the basic phenomena influencing the attenuation on communication paths and discusses various methods for their estimation. Since the most significant attenuation on the communication link is due to rain, the paper concentrates on the theoretical calculation of rain probability curves using various rain models and meteorological data on rain for a given location. The application of the results on the design of space communication systems is also discussed.

26. The Moskva and Moskva-Globalnaya Television Distribution Systems (Lev Kantov; Ministry of Posts and Telecommunications, USSR).

56. The Moskva system is used to distribute television programs to any region of the USSR without interference with terrestial services. It utilizes a special transponder on the GORIZONT multi-purpose satellite which has higher power to meet the requirements of its specialized distribution network. It employs a narrow beam shaped to the broadcasting service area. The receiving stations are equipped with small antennas (2.5m) with no pointing system.

57. The Moskva-Globalnaya system also uses high-power transponder on a GORIZONT Satellite. However, the system employs a global beam antenna operating with a high-power transponder and illuminates the surface of the earth visible from the satellite. Due to its design, this system uses 4 m antennas at receiving stations.

27. Earth Station of Class II in the 11/14 GHZ band Designed by Czechoslovakia and the USSR (Mr. Micolaschec - Tesla - Czechoslovakia)

58. This paper discussed the characteristics and technical performance data of the Earth Station of Class Two in the 11/14 GHz band i.e. application, Station composition and basic technical parameters. The Earth Station has been designed for duplex land-based stations intended for the reception of a colour television signal with 2 accompanying sounds, and for a contingent reception of a digital signal.

28. Satellite Videc Conference System (N.G. Kharatislilli; State Committee for People's Education, USSR)

59. The lecturer discussed the progress achieved in the last few years in the reduction of the cost of video transmission system and the improvement of its performance characteristics from the point of view of subjective perception of transmitted pictures via satellite. The lecturer concluded by citing various examples of video conference systems classification based on the composition and parameters of the terminal equipment as well as projected and available services.

29. Overview Excursion around Site No. 4 of the International Experimental Centre "DUBNA-INTERCOSMOS" (V.L. Bykov; Ministry of Posts and Telecommunications of the USSR)

60. This was the second study tour of the International Satellite Communication Centre of Dubna-Intercosmos, site number 4 at Sochi. During the tour, Professor Bykov described the types of experiments being conducted under international cooperation programme, Intercosmos. The details of the experimental investigation at site number 4 were the same as those given in lecture number 18. The Sochi site 4 was selected because of the amount of rain fall.

ROUND TABLE SESSIONS AT SOCHI

61. This session of the seminar consisted of three sections. In the first section, individual participants were asked to give a brief account on the state of their national satellite communication systems and the future development trends. The second part was general discussion of prospects of international cooperation in the field of satellite communications and the final section was a forum for exchange of opinions on the seminar results as well as its impact. A summary of each section is presented below.

Status of National Satellite communication systems

62. During this section, each participant reported on the type of satellite communications, earth station, mode of operations, number of circuits and their corresponding partners. In some cases, participants reported on their entire network systems. The problems of operations maintenance and space parts were highlightened. Also reported were their continuing efforts to cope with these problems and the future development plans which, if successfully implemented, would improve communication services in their respective country. The most notable aspects of these reports are the lack of direct connections among African countries, power supply problems, maintenance pro well as the need forssfully developing rural telecommunication services.

Prospects of International Co-operation in the Field of Satellite Communications

63. After a lengthy exchange of views on the subject of international cooperation, it became evident from the participants that international co-operation between Africa and all friendly countries was fundamental for the development of space communications. Some of the areas highlighted during the discussion for future co-operation with the USSR were:

1. Assistance in the development of their human resources through training courses, workshops and seminars at various levels.

2. Assistance in the establishment of a regional African Satellite Communication System, and

3. Assistance in the establishment of basic research and development (R & D) programmes in Africa.

64. Other areas noted were the use of the Intersputnik satellite communications systems and participation in the existing international cooperation intercosmos programme which is dealing with amongst others, the assessment of rain effects on trasmission over satellite links in the frequency bands above 10 GHZ, development and experimental test of concepts and recommendations concerning future satellite communications and broadcasting system intended for international and domestic use. From the ensuing discussions participants also expressed their willingness to initiate cooperation with India.

8. SEMINAR EVALUATION

65. After exchanging views on the seminar's results, it was the opinion of the participants that the seminar was very useful. It had provided the right forum where participants met with their colleagues from other African countries and the USSR to exchange knowledge in the new development of satellite communications. The participants expressed their desire for such seminars to be organized in the future. It would be useful, observed some participants, to have seminars on rural satellite communications and to have INTELSAT invited to the seminar. In future seminars, the organizers should consider having two seminars, one on an advanced level for senior technical personnel dealing with policy issues and the other should be for technicians concerned with the operations of satellite earth stations. And, for all future seminars, all efforts should be made to send details of the seminar programme well in advance. This would assist the African countries wishing to participate in the seminar in selecting the appropriate candidates. Also references on subjects discussed at the seminar should be made available.

66. In concluding this section most participants indicated that the seminar had a positive impact on them. It had provided some new ideas that would no doubt be applied to their daily work at home.

9. ECA'S COMMENTS AND RECOMMENDATIONS

67. Each lecture presented at the seminar was followed by discussions on the content of each lecture. During the discussions, questions, answers and elucidation were given. There were altogether three lecture sections and two study visits, to the International Satellite Communications Centres and the International Expertimental Centre - (Dubna Intercosmos) both at Dubna and Sochi.

68. From the discussions of the Round Table session, it can be seen that the seminar did achieve its objectives and had some positive impact on the participants which would no doubt assist them in their daily work at home.

69. It should be observed that this seminar was intended for senior African professionals with satellite communication engineering background, concerned with communications policy, telecommunications and broadcasting (radio and television) which most participants were. Therefore, for those participants lacking the prerequisite, found the seminar to be too advanced. That is why some participants expressed the wish that in the future, seminar on practical training for lower level technician should be organized.

70. On the issue of sending seminar programme to member States in advance, this would be taken into consideration for future seminar.

71. However, there were some shortcomings in the organization of the seminar. Some of these areas were: the timely receipt by ECA of comments on the project document from the concerned parties, the transfer of funds by UNDP and the issuance of tickets by Aeroflot as prescribed in the project document as well as htoel accommodation arrangements. The restrictions of participants using only Aeroflot and its limited flights to and from Africa, sometimes once a well also posed some problems. These shortcomings had a serious impact on the number of participants attending the seminar.

72. In order to improve the attendance of future seminars, it is recommended that the organizational structures as outlined in paragraph 71 should be reviewed. Also the duration of the seminar, that is the working sessions should be reduced to one week allowing an extra week for travelling. The seminar programme, particularly the lectures would have to be tailored, in some cases to suite the African environments.

10. CLOSING SESSION

73. The seminar was formally closed on 25 July 1988 by the deputy Minister, Mr. Yu. Zubarev, Ministry of Posts and Telecommunications of the USSR, who handed out certificates of course completion to all participants on behalf of the Organizers.

74. The vote of thanks to the host Governments, the USSR Ministry of Telecommunications, MVES, UNDP, ECA, PATU and ITU was given on behalf of all participants by Mr. Amedjonekou Kounou from Togo and Mr. R.D. Arya from India.

PROGRAMME OF THE REGIONAL SEMINAR ON SATELLITE COMMUNICATIONS TECHNOLOGY

Monday, July 11
MOSCOW WORLD TRADE CENTER

10.30-11.30	Opening of the Seminar.
	Address by Mr. T.J. Baxter reprentative of United Nations Economic Commission for Africa
	Address by Mr. Rajabu M. Yusuf, Secretary General of PATU
	Address by V.M. Chliarov, MEER
	Address by Mr. Yu B. zubarev, Deputy Minister of Posts and Telecommunications of the USSR
11.30-12.15	Break
12.15-13.15	Current satellite communications techniques and services B. Humm, ITU
13.15-15.00	Lunch
15.00-16.00	Prospects of space technology and applications in Africa. Mr. Ata S. Koran, OAU
16.00-17.00	Cooperation of countries-participants of INTERCOSMOS programme in space communications
	L. Ja Kantor, V.A. Borovkov, Ministry of Posts and Telecommunications of the USSR.

Tuesday, July 12

10.00-11.00	Cooperation of the countries members of the Council for Mutual Economic Assistance in the Comprehensive programme of scientific technical progress in the field of satellite communications M.S. Raber, Ministry of Posts and Telecommunications of the USSR.

11.00-12.00	Soviet satellite technology and possibilities of commercial cooperation of the USSR with other countries A.P. Bachurin, USSR GLAVCOSMOS.
12.00-12.30	Break
12.30-13.30	Basic reuslts of the CCIR study in the field of satellite television broadcasting M.I. Krivosheev, V.A. Borovkov, Ministry of Posts and Telecommunications of the USSR
13.30-15.00	Lunch
15.00-16.00	Planning of the use of the geostationary-satellite orbit by satellites of the fixed satellite service. L. Ja. Kantor, Ministry of Posts and Telecommunications of the USSR
16.00-17.00	Current regulatory procedures for the use of geostationary - satellite orbit and possible approaches to their improvement at the second session of the WARC-ORB. V.V. Timofeev, Ministry of Posts and Telecommunications of the USSR

Wednesday, July 13

10.00-11.00	regional African Satellite Communications System (RASCOM) - in the context of WARC-ORB (2). B. Humm, ITU
11.00-12.00	The challenges of telecommunications development in rural Africa. R.M. Okello, UNTACDA
12.00-12.30	Break
12.30-13.30	Satellite television broadcasting system EKRAN-M D.L. Zajtsev, Ministry of Posts and Telecommunications of the USSR
13.30.15.00	Lunch
15.00-16.00	USSR Satellite earth stations. G.A. Korolev, Ministry of Posts and Telecommunications of the USSR

16.00-17.00	Container-type earth stations designed in the USSR Yu. M. Payansky, K.G. Trakhtenberg, Ministry of Posts and Telecommunications of the USSR
	Thursday, July 14
10.00-11.00	Development of telecommunications by satellite in Africa M. Boye, PATU
	Two reports from the Administration of India
	Two reports from "Rohde and Schwarts".
	Friday, July 15
	Excursion about Zvezdnyi Gorodok
	Saturday, July 16
	Departure for Dubna. Accomodation
	Sunday, July 17
14.30	Opening of the Seminar session at Dubna
	International experimental segment "Dubna-Intercosmos" V.L. Bykov
	Overview excursion around the International experimental Centre "Dubna-Intercosmos".
	Overview excursion around the International satellite communications center "Dubna".
	S.N. Dobromyslov, Ministry of Posts and Telecommunications of the USSR.
	Monday, July 18
10.00-11.00	Measuring basic technical characteristics of the satellite transponder
	S.N. Dobromyslov, Ministry of Posts and Telecommunications the USSR

11.00-12.00	New methods of high grade and high definition television transmissions by satellite links V.S. Rabinovich, D.A. Fedorov, V.A. Bykhovsky, Ministry of posts and Telecommunications of the USSR
12.00-12.30	Break
12.30-13.30	Effective methods of TV signals digital conversion in satellite systems. N.G. Haratishvili, State Committee for People's Education
13.30-14.30	Effective encoding methods for satellite circuits B.L. Banket, Ministry of Posts and Telecommunications of the USSR
14.30-16.00	Lunch
16.00-17.00	Practical exercises at the International experimental centre - demonstration of 12/24 Mbit/sec digital television equipment
	Tuesday, July 19
	Departure for the airport "Vnukovo"
	Departure for Sochi
	Arrival, accomodation at the "Dagomys" hotel
	Wednesday, July 20
10.00-10.30	Opening of the seminar session in Sochi
11.30-11.30	Statistical power budget calculation for satellite links above 10 GHz. V.L. Bykov, Ministry of Posts and Telecommunications of the USSR
11.30-12.00	Breadk

12.00-13.00	Attenuation on space and terrestrial communication links at 10 GHz and above. V.N. Pozhidaev, Institute of Space Research, USSR Academy of Science
13.00-15.00	Lunch
15.00-16.00	Earth station of class II in the band 11/14 GHz designed by Czechoslovakia and the USSR. L. Bodanski, Tesla-Czechoslovakia
16.00-17.00	Videoconference satellite systems N.G. Haratishvilli, State committee for People's Education

Thursday, July 21

9.30	Departure from the "Dagomys" hotel
10.30-13.00	Overview excursion around Site No. 4 of the International experimental centre "Dubna-Intercosmos" V.L. Bykov, Ministry of Posts and Telecommunications of the USSR
13.00	Departure from Site No 4 of the International experimental centre in Dagomys
14.30-16.00	Lunch
16.00-17.00	Television distribution systems MOSKVA and MOSKVA GLOBALNAIA **L.a.** Kantor, Ministry of Posts and Telecommunications of the USSR

Friday, July 22

10.00-13.00	"Round table" session. Reports of countries participants on the state of national satellite systems Discussion of prospects of international cooperation in the field of satellite communications

13.30-15.00	Lunch
15.00-17.00	"Round table" session
	Exchange of opinions on the seminar results.
	Saturday, July 23
	Social event
	Sunday, July 24
	Departure for Moscow
	Monday, July 25
10.00	Closing of the Seminar
19.00	Reception
	Tuesday, July 26
	Consultations and discussions if necessary

REGIONAL SEMINAR ON SATELLITE COMMUNICATION TECHNOLOGY

USSR, 11 - 26 July 1988

LIST OF PARTICIPANTS AND LECTURERS

ALGERIA

Mr. Fihakhir Mustapha
Engineer
Post and Telecommunication
DOPT Tamanrasset Algeria
Algers, Algeria

ANGOLA

Mr. Anibal Lopes Cordeiro
Chief, Traffic and Operation Dept.
Post and Telecommunications
P. O. Box 625
Luanda, Angola

BENIN

Mr. Zodehougan Urbain
Chief, Satellite Earth Station
Post and Telecommunications
Cotonou, Benin

BURKINA FASO

Mr. Felix Damiba
Chief
Transmission Dept. P & T
Ouagadougou
Burkina Faso

BURUNDI

Mr. Philippe Kanzinya
Chief, Transmission Services
Post and Telecommunications
C/O ONATEL
B.P. 60
Bujumbura, Burundi

CONGO

Mr. Gatse Henri Daniel
Chief, Int. Telecommunications Network
Post and TelecommunicationB.P. 703
Brazzaville, Congo

COTE D'IVOIRE

Mr. Gnon Lesan Basile
Engineer
ONT
01 BP 1838
Abidjan, Cote d'Ivoire

DJIBOUTI

Mr. Houssein Arreh
Electrical Engineer
B.P 97
Djibouti, Djibouti

EGYPT

Ms. Aida Ahmed M. Hezza
Manager MAADI Sat. Earth Station
Sat. Telecommunications Authorities
Cairo, Egypt

ETHIOPIA

Mr. Gedam Mehanzel, Chief
Sat. Earth Station
Ethiopian Telecommunications Authority
Addis Ababa
Ethiopia

EQUATORIAL GUINEA

Mr. Bonifacio Ango Nka
Telecommunication Engineer
Post and Telecommunications
B.P. 11
Malabo, Equatorial Guinea

GUINEE

Mr. Bangaly Dabo
Maintenance, Office Post and Telecommunications
Conakry, Guinea

GUINEE BISSAU

Mr. Joao Jose Correia Rosa
Chief, Transmission Section
Post and Telecommunications
Caika Postal 200
Bissau, Guinea Bissau

Mr. Duarte Pereira
Telecommunications Engineer
Post and Telecommunications
Bissau, Guinea Bissau

KENYA

Eng. Gathuri Njorohio
Senior Executive Engineer
Post & Telecommunications Corporation
P. O. Box 30301
Nairobi, Kenya

LIBYA

Mr. Zakaria Ahmed Al Hamali
Engineer GPT
B.P. 2048 LN
Algers, Algeria

MADAGASCAR

Mr. Rakotojoelina Aime Desire
Chief, Microwave Division MPT
Antananariv, Madagascar

MALI

Mr. Daouda Diakite
Chief, Study and Programme Management of
Telecom. Equipment, OPT
Bamako, Mali

Mr. Sekou Coulibaly
Directeur
Technique Radiodiffusion
Television du Mali
B.P. 171
Bamako, Mali

MOZAMBIQUE

Mr. Florencio Da Silva Mandofa
Satellite Earth Station
Maintenance Engineer Supervisor
Mocambique Telecom
Caixa Postal 247
Maputo, Mozambique

NIGER

Mr. Tinni Ate
Chief
Division Transmission
OPT
Niamey
Niger

RWANDA

Mr. Kalinijabo Augustin
Chief, Satellite E/S Dept
B.P. 1332
Kigali, Rwanda

SAO-TOME & PRINCIPE

Mr. Jose Da Graca Diogo
Engineer Radio Communications ENATEL
Sao-Tome & Principe

SENEGAL

Mr. Alain Gueye
Electrical Engineer CONATEL
Dakar Senegal

SIERRA LEONE

Mr. Edward R. Taylor
Acting Enginer Satellite Earth Station
Freetown, Sierra Leone

SUDAN

Mr. Mohammed Osman Ahmed
Technical Administrator
Dar El Hatif
Khartoum
Sudan

SWAZILAND

Mr. Petros Mkhonta
Engineer, Frequency Management
Posts and Telecoms
P. O. Box 125
Mbabane, Swaziland

TANZANIA

Mr. E.I. Kidaha
Senior Engineer, TPTC
P. O. Box 2991
Dar-es-Salaam, Tanzania

Mr. Masudi Ally
Senior Sectional Engineer, TPTC
Dar-es-Salaam, Tanzania

TCHAD

Mr. Serry Ndinga-Hadoum
Chief, Office of Planning
and Studies, ONPT
N'Djamena, Tchad

TOGO

Mr. Amedjonekou Kounou
GBE, Controler External
Telecommunications Satelit
P. O. Box 2301
Lome, Togo

UGANDA

Mr. Elias R. Bahanda
Executive Engineer, MPOMA Satellite Earth Station
Uganda Posts and Telecommunications Corporation
P. O. Box 7171
Kampala, Uganda

ZAMBIA

Mr. Fabian Hatyoka
Senior Engineer
Posts and Telecommunications Corporation
P. O. Box 71660, Ndola
Zambia

ORGANIZATIONS

INTERNATIONAL TELECOMMUNICATION UNION
(ITU)

Mr. Bernard Humm
Technical Cooperation Department
ITU
CH 1211 Geneva 20
Switzerland

PAN-AFRICAN TELECOMMUNICATIONS UNION
(PATU)

Mr. Rajabu M. Yusuf
Secretary General, PATU
Kinshasa, Zaire

Mr. Mouhamodou Boye
Director of Dept. Training
and Technical Co-operation
PATU, Kinshasa, Zaire

ECONOMIC COMMISSION FOR AFRICA
(ECA)

Mr. T. J. Baxter
Acting Chief, Communications Unit
Transport, Communications and Tourism Div.
ECA
Addis Ababa, Ethiopia

Mr. Robert M. Okello
Deputy Co-ordinator
Communications UNTACDA Unit
Transport, Communications and Tourism Div.
ECA, Addis Ababa, Ethiopia

INDIA

Mr. K.G. Matapurkar
Telecommunication Research Centre, DOT
806, Devika Tower
Nehru Place, New Delhi - 19
India

Mr. R.D. Arya
General Manager Maintenance, Dot
Kidwai Bmavan, Janpath
New Delhi 1
India

USSR

Mr. Zubarev Yu B.
Deputy Minister of Posts and Telecommunications
of the USSR
Gorky Street 7
Moscow
USSR

Mr. Varbansky A.M.
Deputy Chief
Department of Radio and
Space Communications
Ministry of Posts and Telecommunications of the USSR

Mr. Chirkov B.I
Deputy Chief
Department of External Relations
Ministry of Posts and Telecommunication of the USSR
Moscow, USSR

Mr. Barinov E.L.
Leading Engineer
Department of external Relations
Ministry of Posts and Telecommunications
of the USSR
Moscow, USSR

Mr. Bykhov V.L.
Professor
Radio Research Institute
Ministry of Posts and Telecommunications of the USSR
Moscow, USSR

Professor Kantor L.Y.
Radio Research Institute
Ministry of Posts and Telecommunications
of the USSR
Moscow, USSR

Professor Krivoshecv M.I
Radio Research Institute
Ministry of Posts and Telecommunications
of the USSR
Moscow, USSR

Professor, Timofecv V.V.
Radio Research Institute
Ministry of Posts and Telecommunications of the USSR
Moscow, USSR

Dr. Zaitsev D.L.
Radio Research Institute
Ministry of Posts and Telecommunications
of the USSR
Moscow, USSR

Dr. Payansky Yu. M
Radio Research Institute

Dr. Rabinovich V.S.
Radio Research Institute

Professor Kharatishvili N.T.
Georgian Polytechnical Institute
State Committee of Education

Dr. Bachurin A.P.
Glavcosmos
Moscow, USSR

Dr. Pohzydaev V.N.
Institute of Radio and Electronics
USSR Academy of Sciences
Moscow, USSR

Mr. Korolev G.A.
Director General
Space Communications Organization
Moscow, USSR

Mr. Fetisov S.A.
Protocol Department
Ministry of Posts and Telecommunications

Mr. Volodin V.A.
Protocol Department
Ministry of Posts and Telecommunications

Mr. Gurov N.A.
Protocol Department
Ministry of Posts and Telecommunications

Dr. Shurikov A.A.
Moscow Telecommunication Institute

Dr. Kanayan S.N.
Central Telecommunications Institute
Moscow, USSR

Mr. Amtzimovich M.A.
Leading Engineer
SKs-2
Moscow, USSR

Mr. F. Kobakhidze
GSSR, Tbilisi
Lenin Str. 1
Moscow, USSR

Mr. T. Vekua
GSSR, Tbilisi
Lenin Str.1
Moscow, USSR

Mr. M. Kotia
GSSR, Tbilisi
Lenin Str.1
Moscow, USSR

Mr. Mikolashek
Tesla
CSSR

Mr. B. Gvandzilia
GSSR, Tbilisi
Lenin Str. 1
Moscow, USSR